REVIEW ARTICLE

THE USE OF PLATELET-RICH PLASMA IN ORAL SURGERY

Zastosowanie osocza bogatopłytkowego w chirurgii stomatologicznej

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Abstract

Introduction: Contemporary oral surgery focuses on minimally invasive techniques and methods that support tissue healing and regeneration. One of the modern approaches involves the use of platelet-rich plasma (PRP), a concentrated plasma fraction containing platelets and growth factors such as PDGF, TGF-β, and VEGF, which play key roles in regenerative processes and angiogenesis. PRP has wide applications in oral surgery, including procedures such as tooth extractions, implant placements, bone augmentations, and soft tissue regeneration. Due to its pro-regenerative and anti-inflammatory properties, PRP contributes to shorter recovery times, reduced pain, and improved quality of newly formed tissue. **Materials and methods:** A systematic review of the literature from the PubMed database was conducted to analyse publications on the use of PRP in dental surgery. **Conclusions:** PRP is a promising tool supporting tissue regeneration in dental surgery due to the presence of multiple growth factors that play an essential role in angiogenesis, cellular proliferation, and extracellular matrix remodeling. In the context of tooth extraction, PRP helps reduce pain, swelling, and the risk of complications, while also accelerating soft tissue regeneration. For bone augmentation procedures, it supports osteogenesis, particularly when combined with bone substitute materials, although its effectiveness depends on several factors, such as the quality of the biomaterial and surgical technique. PRP used in sinus lift and implantology has shown moderate outcomes, and its efficacy in promoting peri-implant tissue regeneration remains a subject of debate. In periodontology, PRP supports soft tissue and periodontal regeneration, accelerating wound healing and the restoration of connective tissue attachment. PRP represents a valuable adjunct in oral surgery; however, given the lack of clear evidence on its efficacy in bone regeneration, further clinical studies and standardization of PRP preparation and application methods are needed.

Streszczenie

Wprowadzenie: Współczesna chirurgia stomatologiczna koncentruje się na technikach minimalnie inwazyjnych oraz metodach wspomagających procesy gojenia i regeneracji tkanek. Jednym z nowoczesnych podejść jest zastosowanie osocza bogatopłytkowego, które stanowi skoncentrowaną frakcję osocza zawierającą płytki krwi i czynniki wzrostu, takie jak PDGF, TGF-β i VEGF, odpowiedzialne za procesy regeneracyjne i angiogenezę. Osocze bogatopłytkowe znajduje szerokie zastosowanie w chirurgii stomatologicznej, w tym w procedurach takich jak ekstrakcje zębów, zabiegi implantologiczne, leczenie ubytków kostnych oraz regeneracja tkanek miękkich. Dzięki swoim właściwościom proregeneracyjnym i przeciwzapalnym przyczynia się do skrócenia czasu rekonwalescencji, zmniejszenia dolegliwości bólowych oraz poprawy jakości nowo tworzonej tkanki. **Materiał i metody:** W badaniu przeprowadzono systematyczny przegląd literatury dostępnej w bazie PubMed, analizując publikacje dotyczące zastosowania osocza bogatopłytkowego w chirurgii stomatologicznej. **Wnioski:** Osocze bogatopłytkowe jest obiecującym narzędziem wspomagającym regenerację tkanek w chirurgii stomatologicznej dzięki obecności licznych czynników wzrostu, które odgrywają istotną rolę w angiogenezie, proliferacji komórkowej oraz przebudowie macierzy pozakomórkowej. W przypadku ekstrakcji zębów pomaga w redukcji bólu, obrzęku i ryzyka powikłań, a także przyspiesza regenerację tkanek miękkich. W zabiegach augmentacyjnych wspiera osteogenezę, szczególnie w połączeniu z materiałami kościozastępczymi, jednak zależy to od wielu czynników, takich jak jakość biomateriału i technika chirurgiczna. Wyniki zastosowania PRP w zabiegach podniesienia dna zatoki szczękowej oraz implantologii są umiarkowane, a jego skuteczność w regeneracji tkanek otaczających implanty jest wciąż przedmiotem debat. W periodontologii wspomaga regenerację tkanek miękkich i przyzębia, przyspieszając gojenie ran i odbudowę przyczepu łącznotkankowego. Osocze bogatopłytkowe stanowi wartościowe wsparcie w chirurgii stomatologicznej, ale ze względu na brak jednoznacznych dowodów na skuteczność w regeneracji kostnej, konieczne są dalsze badania kliniczne i standaryzacja metod jego przygotowania i aplikacji.

Keywords: oral surgery; platelet-rich plasma; PRP

Słowa kluczowe: chirurgia stomatologiczna; osocze bogatopłytkowe; PRP

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Introduction

Modern dental surgery is rapidly evolving toward minimally invasive techniques and approaches that promote tissue healing and regeneration. One such approach involves the use of autologous blood concentrates, particularly platelet-rich plasma (PRP). PRP is a plasma fraction enriched in platelets, which serve as a source of many growth factors, including platelet-derived growth factor (PDGF), transforming growth factor beta (TGF-β), and vascular endothelial growth factor (VEGF). These agents play a key role in regenerative processes and angiogenesis [1, 2].

PRP is used in dental surgery across a wide range of procedures, including tooth extractions, implantology, bone defect treatment, and the promotion of healing following soft tissue procedures [3]. Owing to its pro-regenerative and anti-inflammatory properties, PRP may shorten recovery time, reduce postoperative pain, and improve the quality of newly formed tissue [4].

The aim of this paper was to review the available scientific evidence regarding the mechanism of action of PRP and its clinical efficacy in dental surgery. Both *in vitro* findings and clinical reports were analysed to evaluate the therapeutic potential of this approach in dental practice.

Materials and methods

Data were sourced from scientific publications indexed in the PubMed database. A systematic literature review was conducted encompassing studies on the use of PRP across various domains of dentistry, with particular emphasis on oral surgery. The literature search was conducted between February and May 2025. Only scientific articles published in English or Polish and available as full-text online publications were included. Systemic diseases affecting the healing process or platelet count, smoking, and pregnancy were the exclusion criteria. The following keywords were used for literature search: PRP, healing process, tooth extraction, dental implants, bone augmentation, periodontology, and soft tissue. Studies published in peer-reviewed scientific journals with direct relevance to the topic of the present review were included in the analysis.

Characteristics of PRP – mechanism of action, impact on the wound healing process and methods of preparation

The regenerative properties of PRP are primarily attributable to the high concentration of platelets, which constitute the principal mediators of this preparation's biological activity. The standard normal platelet count in healthy adults is 150 to 300 × 10^9/L. Their average lifespan is 8–10 days. Beyond their haemostatic function, platelets play a critical and indispensable role in tissue regeneration and wound healing, particularly during the initial inflammatory phase. Wound healing typically occurs in a pro-inflammatory environment, where elevated proteolytic enzyme activity restricts the availability of endogenous growth factors essential for tissue regeneration. To counteract these unfavourable conditions, PRP provides a concentrated exogenous source of growth factors, supporting tissue regeneration through its mitogenic, angiogenic, and chemotactic properties [5]. Platelets contain three main types of granules: alpha granules, dense (delta) granules, and lysosomes, with each group harbouring a distinct set of mediators that coordinate the repair process. Alpha granules are of particular relevance in the regenerative context, serving as a principal source of numerous growth factors, cytokines, adhesion molecules, and signalling proteins. These include, among others, PDGF (αα, ββ, and αβ isoforms), VEGF, insulin-like growth factor (IGF), TGF-β1, TGF-β2, epidermal growth factor (EGF), interleukin-1, osteocalcin, osteonectin, as well as structural proteins such as fibrinogen, vitronectin, fibronectin, and thrombospondin [2, 6, 7]. In addition to platelets, PRP also contains leukocytes, plasma, and erythrocyte remnants [2]. The effects of PRP derive in part from the activity of PDGF, which has been identified as a key mediator in the healing of both hard and soft tissues. PDGF has been shown to stimulate chemotaxis, mitogenesis, and stem cell replication at sites of wound and tissue damage. This induces bone matrix formation and angiogenesis through the upregulation of VEGF, which may consequently accelerate soft tissue healing via neovascularization. PDGF additionally stimulates the synthesis of fibronectin, a cell adhesion molecule involved in cell proliferation and migration during the healing process, including osteoconduction of hyaluronic acid, and contributes to wound contraction and remodelling [8].

PRP represents an autologous product as it is prepared from the patient's own venous blood. The preparation procedure involves isolating plasma fractions and concentrating platelets to levels substantially exceeding those observed in peripheral circulation under physiological conditions. This is typically achieved through centrifugation of the collected venous blood. Evidence suggests that a platelet concentration approximately 2.5–5 times higher than baseline levels is optimal for maximiz-

ing regenerative effects [9, 10]. In clinical practice, PRP is obtained through centrifugation of peripheral blood. Following centrifugation of anticoagulant-treated blood, the sample separates into three distinct layers: a dense bottom layer of red blood cells, an intermediate "buffy coat" containing platelets and leukocytes, and an upper plasma layer [11]. Further processing of the plasma and buffy coat layer through additional centrifugation allows for the isolation of PRP. Commercially available PRP preparation kits are also widely used, incorporating separation gels that facilitate platelet isolation during centrifugation and enabling standardized, reproducible outcomes. PRP gel is produced by combining platelet-rich plasma with thrombin or calcium chloride, typically at a concentration of 10%. The addition of thrombin and calcium chloride induces automatic activation of alpha granules, triggering the release of biologically active growth factors [7]. Numerous protocols and techniques for PRP preparation have been described in the literature, alongside a wide range of therapeutic applications. However, methodological variability and inconsistent nomenclature across studies complicate the interpretation and comparison of results, often introducing ambiguity and limiting the generalizability of conclusions [11, 12].

PRP derived from the patient's own venous blood eliminates the risk of viral pathogen transmission associated with allogeneic blood products. The autologous origin of PRP likewise precludes the risk of prion contamination and virtually eliminates the possibility of allergic or other immune-mediated adverse reactions. It should be noted, however, that the use of bovine thrombin as an exogenous activator in PRP preparation may be associated with acquired coagulopathies due to cross-reactivity of antibodies directed against bovine factor V with its human counterpart [13]. To date, no evidence of carcinogenic effects associated with the clinical use of PRP has been reported [14, 15].

Results

During the selection process, 305 publications were initially identified, of which 142 were excluded at the preliminary stage. The remaining 163 papers underwent abstract review, following which a further 121 were excluded. Forty-three papers were considered for further analysis, of which three were excluded upon verification of detailed exclusion criteria. Ultimately, 40 papers were included in the systematic review, comprising seven comparative studies, five clinical trials, and nine randomized controlled trials.

Discussion

Autologous PRP concentrates represent a valuable adjunct that supports regenerative processes in dental surgery, demonstrating the potential to modulate tissue repair through the activity of multiple bioactive growth factors. The mechanism of action of PRP is based on the induction of angiogenesis, stimulation of mesenchymal cell proliferation, promotion of extracellular matrix component synthesis, and enhancement of bone mineralization. These preparations are employed across a broad range of dental procedures, including the management of extraction sockets, augmentation procedures, implant therapies, sinus lift procedures, and soft tissue regeneration. Despite numerous reports documenting beneficial clinical effects of PRP, its therapeutic efficacy remains under ongoing investigation. Outcomes may be substantially influenced by variations in preparation protocols, platelet concentrations, and individual patient clinical characteristics.

PRP preparation protocols varied across the analysed studies. The results and a summary of the parameters employed for PRP preparation are presented in Tables 1–4.

Extraction sockets

Tooth extraction is among the most frequently performed surgical procedures in dentistry. Despite its routine nature, it may give rise to numerous complications that can substantially impair the healing process. The most common complications include pain, oedema, trismus, infection, and dry socket. In some cases, tissue regeneration may be delayed, adversely affecting treatment outcomes and patient comfort [16, 17].

Table 1. Platelet-rich plasma (PRP) preparation protocols and research findings regarding its effect on post-extraction sockets

Study	Parameters		Activator used	Outcomes
	First centrifugation	Second centrifugation		
Biomet, Indiana, USA [16]	1000 rpm for 10 minutes	1000 rpm for 10 minutes	10% $CaCl_2$	More rapid soft tissue healing, reduced rates of local complications such as dry socket, diminished postoperative pain, and improved trabecular bone structure on radiographic imaging in PRP-treated areas
Haydarpaşa Training Hospital, Istanbul [19]	1200 rpm for 10 minutes	1000 rpm for 10 minutes	-	No significant differences in new bone formation between PRP-treated and control groups
Dental Services Department, Nigeria [20]	1200 rpm for 10 minutes	1000 rpm for 10 minutes	10% $CaCl_2$ and 1000 U of bovine thrombin	Reduced pain and oedema, improved range of mouth opening
Duquesne University [21]	1150 rpm for 10 minutes	-	-	Increased radiographic bone density in PRP-treated areas; no significant observations regarding postoperative pain or bleeding severity

Table 2. Platelet-rich plasma (PRP) preparation protocols and research findings regarding its effect on bone augmentation

Study	Parameters		Activator used	Outcomes
	First centrifugation	Second centrifugation		
Maharishi Markandeshwar College of Dental Sciences and Research, Mullana [26]	200 × g for 20 minutes	400 × g for 10 minutes	-	No significant differences were identified for osseointegration or the quality of newly formed bone tissue
Yeditepe University, Istanbul [27]	2,400 rpm for 10 minutes	3,600 rpm for 15 minutes	10% $CaCl_2$	Superior efficacy of PRP combined with xenograft material relative to standard augmentation procedures has not been confirmed
Kenia Dental College, Nepal [28]	2000 rpm for 15 minutes	3000 rpm for 10 minutes	10% $CaCl_2$	Autologous PRP is biocompatible and significantly improves soft tissue healing, bone regeneration, and bone density in extraction sockets
King Saud University, Saudi Arabia [29]	200 × g for 20 minutes	400 × g for 10 minutes	10% $CaCl_2$	Improved healing of soft tissues, faster bone regeneration in the socket with the use of PRP

Table 3. Platelet-rich plasma (PRP) preparation protocols and research findings regarding its effect on implants

Study	Parameters		Activator used	Outcomes
	First centrifugation	Second centrifugation		
King Saud University, Saudi Arabia [29]	200 × g for 20 minutes	400 × g for 10 minutes	10% $CaCl_2$	Improved healing of soft tissues, faster bone regeneration in the socket with the use of PRP
Biotechnology Institute, Vitoria [30]	460 × g for 8 minutes	-	10% $CaCl_2$	Coating of the implant surface elicits a more dynamic tissue response and promotes accelerated bone mineralization
University of Rome Tor Vergata, Italy [31]	1100 rpm for 10 minutes	-	10% $CaCl_2$	Faster regeneration of soft and hard tissues
Bapuji Dental College and Hospital, India [32]	3000 rpm for 10 minutes	-	-	Minimizing delayed integration of implants into hard and soft tissues
School of Dentistry Sao Paulo, Brazil [34]	1200 rpm for 10 minutes	1200 rpm for 15 minutes	-	The use of PRP in the treatment of peri-implant bone defects does not yield significant improvement in bone tissue regeneration

Table 4. Platelet-rich plasma (PRP) preparation protocols and research findings regrading its effect on sinus lift

Study	Parameters		Activator used	Outcomes
	First centrifugation	Second centrifugation		
Cairo University, Egypt [36]	160 × g for 16 minutes	-	10% $CaCl_2$	No significant differences were observed in the quality of newly formed bone or the efficiency of osseointegration
Medical University of Vienna, Austria [37]	1800 rpm for 10 minutes	3000 rpm for 10 minutes	10% $CaCl_2$ and bovine thrombin	Potential synergistic effects of PRP and synthetic bone substitutes

In response to these challenges, research into methods for accelerating post-extraction regeneration has focused on the use of autologous platelet concentrates, which, by virtue of their high concentration of growth factors such as PDGF, TGF-β, and VEGF, have the potential to favourably modulate the healing environment [18]. PRP preparations are capable of stimulating angiogenesis, fibroblast and osteoblast proliferation, and extracellular matrix reconstruction, thereby potentially contributing to accelerated regeneration of both soft and hard tissues. PRP is therefore regarded as a promising therapeutic tool with the potential to prevent complications

and optimize the healing process following tooth extraction [19].

A 2010 study by Alissa et al. found that PRP significantly accelerated soft tissue healing in extraction sockets compared to controls. Patients who did not receive PRP exhibited a higher incidence of local complications, including dry socket and acute alveolitis. Although these differences were of borderline statistical significance, they suggest a preventive potential for PRP. Radiographic evaluation of healed sockets additionally revealed a marked improvement in trabecular bone structure in PRP-treated areas, although statistically significant differences were observed only in sockets exhibiting dense and homogeneous bone structure. Furthermore, patients treated with PRP reported lower levels of postoperative pain, particularly during the first three days following surgery [16].

Similar observations were reported by researchers assessing the effect of PRP on the healing process following surgical extraction of impacted third molars. The PRP-treated group demonstrated a significant reduction in pain and oedema, as well as improved mouth opening. Differences in radiological parameters, including bone density and trabecular bone structure, were observable, yet did not reach statistical significance [20].

Clinicians from Duquesne University employed digital radiography and computed tomography (CT) to assess changes in bone density within the extraction socket. Their analysis revealed a statistically significant increase in radiographic density in PRP-treated areas, suggesting a beneficial effect on early mineralisation. However, no significant effect of PRP on postoperative pain or bleeding was observed [21].

Despite numerous positive reports demonstrating the efficacy of PRP in improving soft tissue healing and reducing post-extraction complications, evidence regarding its effect on bone regeneration remains more ambiguous. Some studies have failed to confirm significant differences in new bone formation between PRP-treated and control groups, underscoring the need for further well-designed clinical trials and standardized PRP preparation protocols. Given the available evidence, PRP may be assumed to exert a beneficial effect primarily during the initial phase of post-extraction wound healing, supporting early osteogenesis. However, the magnitude of this effect may diminish in later stages of tissue remodelling [22].

Bone augmentation

Augmentation procedures intended to restore mandibular bone may utilize PRP to provide biological support to enhance osteogenesis. Used alone or in combination with bone substitutes, PRP can modulate the local healing environment by activating progenitor cells and initiating bone remodelling. Consequently, PRP may contribute to increased volume and improved quality of newly formed bone tissue. Its mechanisms of action have been confirmed at the cellular level: as early as day 3 post application, increased osteoblast and fibroblast proliferation, enhanced neovascularization, and accelerated bone mineralisation have been observed [23]. These processes form the basis for the application of PRP in implantology and guided bone regeneration (GBR), particularly in cases of significant alveolar process atrophy requiring augmentation prior to planned implant treatment [24].

The osteogenic potential of PRP is supported by both experimental and clinical evidence. For example, Daif (2012) demonstrated that direct application of PRP along mandibular fracture lines may support the healing process by accelerating bone tissue regeneration [25]. A 2007 study comparing bone marrow mononuclear cell transplants containing the CD34+ population with PRP preparations demonstrated that PRP stimulated new alveolar bone formation more effectively than stem cells alone. These findings suggest that the growth factors contained in PRP may positively modulate the osteogenic microenvironment [26].

Although numerous studies indicate a beneficial effect of PRP on bone regeneration, the available evidence remains inconclusive. Some comparative studies comparing platelet concentrates against synthetic alloplasts (such as PerioGlass) and bioresorbable xenografts (e.g., Bio-Oss) failed to demonstrate significant differences in osseointegration or the quality of newly formed bone tissue [27]. Similarly, Cabbara et al. did not confirm superior efficacy of combining PRP with xenograft material compared to standard augmentation procedures [28]. At the same time, other clinical reports demonstrate a statistically significant increase in bone density in areas treated with PRP, particularly at longer follow-up intervals of 1, 4, and 12 months, suggesting a positive effect of PRP on the rate and quality of long-term bone regeneration [29, 30].

Discrepancies in the reported results may be attributable to numerous confounding factors, including the absence of standardized protocols for PRP preparation and application, the heterogeneous physicochemical properties of biomaterials used as carriers, and variability in surgical techniques. These factors substantially complicate the definitive assessment of PRP efficacy relative to conventional bone augmentation approaches.

Implantology

Modern implantology seeks to optimize the early stages of osseointegration with the aim of achieving predictable and durable treatment outcomes. One promising approach involves the use of autologous PRP as a biological adjunct supporting regenerative peri-implant processes [18]. PRP contains high concentrations of growth factors capable of supporting the differentiation of osteoprogenitor cell differentiation, stimulating angiogenesis, and initiating extracellular matrix remodelling [18, 30]. The application of PRP, both to implant surfaces and within the bone bed, may accelerate healing, enhance primary and secondary implant stability, and reduce the risk of postoperative inflammatory complications. Given its biologically active properties, PRP may positively modulate the microenvironment at the implant site, creating conditions that promote effective and durable implant-bone integration [24].

Experimental studies have demonstrated that PRP-coated implants exhibit a higher degree of bone integration.

Anitua confirmed that biological implant coating elicits a more dynamic tissue response and promotes more rapid mineralisation [31]. Similar observations were reported by researchers from the University of Rome Tor Vergata, who, in the context of maxillary reconstruction and post-extraction tissue regeneration, documented a beneficial effect of PRP on the healing process as well as high patient tolerability of this intervention [32]. Furthermore, innovative techniques proposed by Anand et al., involving the application of PRP to the implant surface within immediate loading protocols, suggest the potential for improved treatment outcomes through biological tissue stimulation while minimising delays in the integration of hard and soft tissue structures [33].

Available evidence also suggests that PRP may improve bone density indices and reduce marginal bone loss, parameters that are critical for long-term implant stability and functionality. Taschieri et al. observed that implants placed in fresh extraction sockets demonstrated improved soft tissue integration with PRP, potentially attributable to its angiogenic properties and its impact on collagen expression and extracellular matrix remodelling [34].

It should be noted, however, that the results of clinical trials remain ambiguous. Casati et al. reported that PRP alone failed to yield significant improvement in bone tissue regeneration in the management of peri-implant bone defects [35]. Discrepancies in research findings may be partially explained by the absence of standardized PRP harvesting and activation procedures, biological variability among patients, and heterogeneity in study designs.

Sinus lift

Sinus lift surgery is an important preparatory step for implant placement in the posterior maxilla with insufficient alveolar ridge height. The use of PRP in this procedure aims to enhance angiogenesis and osteogenesis at the graft site. As a biologically active carrier of growth factors, PRP may support bone remodelling and improve treatment outcomes with respect to both the quality of newly formed bone and implant survival.

The use of PRP in combination with bone substitutes, particularly β-tricalcium phosphate (β-TCP), has been assessed as moderately beneficial [36]. Some studies have demonstrated that combining PRP with β-TCP may yield approximately 8–10% greater new bone formation compared to β-TCP monotherapy, without affecting the rate of biomaterial resorption. These findings suggest a potential synergistic effect of PRP and synthetic bone substitutes; however, the efficacy of this approach depends on multiple variables, including the composition and preparation method of the concentrate, the quality of the biomaterial, and the surgical technique employed [37, 38].

It is also noteworthy that not all comparisons of PRP with other graft materials have yielded favourable results. Several studies comparing PRP with alloplastic materials (e.g., PerioGlass) or bioresorbable xenografts (e.g., Bio-Oss) have failed to demonstrate significant differences in the quality of newly formed bone or the efficacy of osseointegration. Such discrepancies may be attributable to inconsistent methodologies, differences in the materials employed, and the absence of standardized PRP preparation protocols [37, 38].

Periodontology and oral soft tissues

Autologous PRP represents a valuable adjunct supporting regenerative processes, with particular relevance to the treatment of periodontal disease and the reconstruction of oral soft tissues. Its therapeutic potential stems from its high concentration of growth factors and bioactive molecules that modulate the local inflammatory response, initiate angiogenesis, and stimulate the proliferation of cells integral to the healing process, including fibroblasts and keratinocytes [29, 37]. These mechanisms promote accelerated epithelial and mucosal regeneration, enhancing the predictability of clinical outcomes in interventions such as gingival recession management, autogenous grafting, and postoperative tissue regeneration.

In periodontology, PRP is employed as an adjunctive biological agent in procedures aimed at reconstructing periodontal structures, including root cementum, the periodontal ligament, and alveolar bone [29]. PRP has the capacity to stimulate progenitor cell migration and differentiation as well as extracellular matrix remodelling, supporting graft integration and the restoration of lost attachment. It has further been documented to promote fibrin clot formation, which translates into increased collagen production and fibroblast proliferation within the wound [21].

Systematic reviews indicate that PRP may improve the healing of periodontal defects, particularly when used in combination with graft materials. Del Fabbro et al. demonstrated a potentially beneficial effect of PRP in the management of intraosseous defects, although no clear benefit was identified in the treatment of gingival recession [3]. Two controlled clinical trials demonstrated that combining PRP with bone graft material yielded superior clinical outcomes compared to graft material alone [39, 40].

Regarding soft tissue healing, three of the four analysed studies reported a statistically significant acceleration of the regeneration process ($p < 0.05$), as confirmed by wound assessments performed at 7–14 day intervals following the procedure [29, 30, 37, 39]. Similar findings were reported by Gawai et al., who demonstrated significantly superior healing outcomes in patients receiving PRP compared to controls [41].

Conclusions

Platelet-rich plasma (PRP) represents a promising adjunct for supporting tissue regeneration in dental surgery, owing to its high platelet concentration and the presence of growth factors such as PDGF, TGF-β, VEGF, and EGF, which play a central role in angiogenesis, cell proliferation, and extracellular matrix remodelling. PRP is employed across a broad range of clinical interventions, including extraction socket management, bone augmentation, sinus lift, implantology, and periodontal surgery.

In the context of tooth extraction, PRP has the potential to reduce pain, oedema, and the risk of complications such as dry socket. Clinical studies indicate accelerated soft tissue regeneration and improved radiographic parameters, although evidence regarding bone regeneration remains inconclusive. In augmentation procedures, PRP may support osteogenesis, particularly when used in combination with bone substitutes, although the efficacy of this approach depends on many factors, including biomaterial quality, surgical technique, and the lack of standardized PRP preparation protocols. PRP demonstrates moderate potential for improving regenerative parameters in sinus lift, although research findings remain inconsistent. In implantology, PRP may accelerate osseointegration and enhance implant stability, primarily through its angiogenic properties and stimulation of peri-implant tissue regeneration. Despite encouraging experimental data, clinical trials remain inconsistent. In periodontology, PRP is employed as an adjunct supporting the regeneration of soft tissues and periodontal structures. PRP has demonstrated a beneficial effect on wound healing, progenitor cell migration, and connective tissue attachment restoration, particularly when used in combination with graft materials.

In summary, PRP represents a valuable adjunct to surgical procedures in dentistry, particularly during the initial stages of healing. However, given the insufficient evidence regarding its efficacy in bone regeneration and the considerable variability in reported outcomes, further well-designed clinical trials and standardisation of preparation and application protocols are warranted.

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